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**KENTUCKY
REPORT TO CONGRESS
ON
WATER QUALITY**

**COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES and
ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION**

DIVISION OF WATER

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report was prepared to fulfill requirements of Section 305(b) of the Federal Water Pollution Control Act of 1972 (P.L. 82-500) as amended by the Water Quality Act of 1987 (P.L. 100-4). Section 305(b) requires that states submit a report to the U.S. Environmental Protection Agency on a biennial basis which assesses current water quality conditions. Topics that are discussed in the report are groundwater quality, the status of the state water pollution control program, water quality conditions and use support of streams, rivers and lakes, a discussion on wetlands, and recommendations on additional actions necessary to achieve the objectives and goals of the Clean Water Act.

Water Quality Assessment

The water quality assessment of rivers and streams in Kentucky's 1990 report is based on those waters depicted on the 1974 U.S. Geological Survey Hydrologic Unit Map of the state. The map contains about 18,500 miles of streams, of which approximately 10,200 miles (55%) were assessed. This is an increase in coverage from the last report.

The assessment is based on an analysis of the support of classified uses. Warmwater aquatic habitat and primary contact recreation uses were most commonly assessed. Full support of uses occurred in 6,630 miles (65%) of the assessed waters and uses were not supported in 1,978.3 (19%). Partial use impairment was found in 1,612.7 miles (16%) miles of the assessed waters. The major causes of use nonsupport were fecal coliform contamination, which affected primary contact recreation use, and organic enrichment and siltation, which impaired warmwater aquatic habitat use. The major sources of the fecal coliform contamination were municipal wastewater treatment plant discharges and agricultural nonpoint sources. Municipal point sources were responsible for the organic enrichment, while surface mining and agricultural nonpoint sources were the major sources of siltation.

A statistical trend analysis showed improvements in water quality, particularly an increase in dissolved oxygen in South Elkhorn Creek, which was attributed to increased treatment of wastewater at the City of Lexington's Town Branch wastewater treatment plant. A trend in the Nolin River showed a deterioration in

water quality which may be the result of the City of Elizabethtown's municipal discharges into Valley Creek, a tributary of the Nolin River.

Several trends were detected statewide, although specific causes were not readily apparent. Chloride increased at 14 of the 47 sites tested. The pH is increasing at many sites and decreasing at none. Total recoverable lead is decreasing at 16 sites and increasing at three sites.

Degradation due to priority pollutants has occurred in some of the state's streams. Fish consumption warnings remain posted for the Mud River and Town Branch in Logan, Butler, and Muhlenberg counties because of the presence of PCBs. A fish consumption advisory is also still in effect for the West Fork of Drakes Creek in Simpson and Warren counties, because of PCBs. These two sites were reported in the last 305(b) Report. Two new advisories have been issued since that report was published. Little Bayou Creek in McCracken County and four locations on the Ohio River were posted with advisories because of PCB contamination. Chlordane contaminated fish were also found at three of the Ohio River areas. The Ohio River advisories are for the consumption of particular species only (catfish at two areas, catfish, carp and white bass at one, and catfish and white bass at the other).

Section 304(l) of the 1987 amendments to the Clean Water Act requires states to focus attention on waters impaired by toxic pollutants. Three lists: a "short list" of waters affected by point source toxic pollutants; a "mini list" of waters affected by point and nonpoint sources of pollutants; and a "long list" of waters affected by all types of pollutants from all sources were prepared in response to this requirement. An update of the short and mini lists is presented in this report. The short list contains 20 stream segments where individual control strategies for point source dischargers of toxic pollutants were developed. Individual control strategies for these segments are Kentucky Pollutant Discharge Elimination System permits containing appropriate numeric effluent limitations.

Forty-two fish kills totalling over 541,000 fish were reported in the past two years, affecting over 153 miles of streams. The number of fish kills reported and the number of waterbodies affected were lower than those reported over the last ten years, but the number of miles affected and the number of fish killed were higher. Fish kills were most commonly attributed to sewage discharges. Bacteriological

surveys were conducted on seven stream drainages. Municipal sewage treatment plant discharges were found to be a major source of recreational use impairment.

The water quality assessment of lakes included more than 90 percent of the publicly owned lake acreage in Kentucky. Sixty-two of 99 lakes fully supported their uses. On an acreage basis, 91 percent (195,749 acres) of the 214,861 assessed acres fully supported uses.

Nutrients were the greatest cause of the uses not being fully supported and affected the largest number of lakes. Nonpoint sources including agriculture, and municipal discharges, were the principal sources of the nutrients. Iron and manganese were the second greatest cause of use nonsupport, and affected domestic water supply uses. Natural release of these metals from bottom sediments into the water column causes water treatment problems.

An analysis of lake trophic status indicated that of the 99 lakes assessed, 56 were eutrophic, 31 were mesotrophic and 12 were oligotrophic. McNeely Lake showed an improvement in water quality. Reformatory, Green River, Spurlington, Campbellsville City, Jericho, and Doe Run lakes became more eutrophic than previously reported. Lake Jericho was added to the list of lakes which did not support their uses. A lake restoration effort that involves liming is being undertaken at Cranks Creek Lake to offset the effects of acid mine drainage. This should change its status from partial support to full support.

Underground storage tanks, septic tanks, abandoned hazardous waste sites, improper well construction, and oil and gas brine pits are estimated to be the top five sources of groundwater contamination in Kentucky. Lack of basic monitoring data prevents an assessment of the magnitude of the problem caused by these sources. Pilot well head protection studies have been initiated to gain experience in methods to detect and evaluate contamination of groundwater.

Protecting public water supplies dependent upon groundwater and lack of consistent data gathering in a useable format by agencies involved in groundwater monitoring, are two of the areas of special concern in the groundwater program. Contamination from oil and gas exploration is another.

Water Pollution Control Programs

Kentucky's water pollution control programs continued expanding to develop new approaches for controlling pollution. By the end of 1989, 66 municipal and 35 industrial wastewater treatment facilities had requirements for biomonitoring. The Division of Water conducted acute and chronic toxicity tests on 54 point source discharges and on instream locations above and below those sources. Pretreatment programs have been approved in 64 cities to better treat industrial wastes. A state revolving fund program has been approved to meet the needs of new wastewater treatment plant construction.

Forty-five primary ambient monitoring stations, which characterized approximately 1,500 stream miles within the state, were in operation during the reporting period. Biological monitoring has occurred at 40 of these stations since 1986. In addition, ten lakes were sampled for eutrophication trends and three lakes for acid precipitation trends. An expanded lake assessment project has been funded by the federal Clean Lakes Program which allowed 34 additional lakes to be sampled for eutrophication trends. Nine intensive surveys were conducted on 763 miles of streams for the evaluation of municipal point source and nonpoint agricultural pollution, oil production effects on water quality, and for assessing recreational use attainability. The survey of the Little River revealed that a large portion of the watershed was being impacted by agricultural activities that caused the warmwater aquatic life use to be only partially supported. Yellow Creek, near Middlesboro, was found to have improved water quality because of better municipal wastewater treatment.

WATER WATCH, a citizen's education program, expanded its membership and more than doubled the number of waters "adopted" by local groups. Since its beginning, 270 groups have been established and 250 streams, 25 lakes, 30 wetlands, and nine karst or underground systems have been adopted. A water quality monitoring project has produced data on stream water quality at 89 sites across the state.

The nonpoint source control program has been involved in monitoring projects in the Mammoth Cave area (Turnhole Spring Groundwater Basin), the upper Salt River/Taylorsville Lake watershed, and the upper Green River watershed. These are recently initiated long term studies aimed at determining nonpoint source impacts and demonstrating water quality improvements from best management practices.

A Nonpoint Source Advisory Committee was formed to help identify new directions for the nonpoint source management program. The program received full approval from the U.S. Environmental Protection Agency in 1989.

An update of the Nonpoint Source Pollution Assessment Report was produced for this report. Streams, rivers, lakes, wetlands and groundwater impacted by nonpoint sources of pollution are listed in an Appendix, along with current information regarding sources and parameters of concern.

BACKGROUND

BACKGROUND

This report was prepared to fulfill the requirements of Section 305(b) of the Federal Water Pollution Control Act of 1972 (P.L. 92-500) as amended by the Clean Water Act of 1987 (P.L. 100-4). Section 305(b) requires that states submit a report to the U.S. Environmental Protection Agency (EPA) every two years which addresses current water quality conditions. Items to be addressed in the report include an assessment of the degree to which nonpoint sources of pollutants affect water quality, an assessment of state groundwater quality, an assessment of the extent to which the state's waters meet their designated uses and the fishable/swimmable goals of the Act, and recommendations on additional actions necessary to achieve the water quality objectives of the Act. Specific data on lake water quality, and information on state programs is also required and addressed in the report. EPA uses the reports from the states to apprise Congress of the current water quality of the Nation's waters and recommend actions which are necessary to achieve improved water quality. States use the reports to provide information on water quality conditions to the general public and other interested parties, and to help set agency pollution control directions.

This report follows the guidance document that EPA provided to the states for the 1990 report. The stream water quality in this report is based on those streams shown on the U.S. Geological Survey's (USGS) Hydrologic Unit Map of Kentucky (scale 1:500,000). The assessments were based on this map's approximately 1,300 streams and rivers which contain about 18,500 stream miles. Stream miles were determined by chord lengths to the 0.1 mile, on USGS 7.5 minute quadrangle maps (scale 1: 24,000). These maps are the official river mile index maps maintained by the Division of Water. Stream miles not measured by this method were determined by using map wheels. Kentucky is divided into 42 cataloging units, which compose the 12 river basins assessed in this report. These drainage basins from east to west are the Big Sandy, Little Sandy, Tygarts, Licking, Kentucky, Upper Cumberland, Salt, Green, Tradewater, Lower Cumberland, Tennessee, and Mississippi. The Ohio River Valley Water Sanitation Commission (ORSANCO) compiles a report on the Ohio River which is used as a supplement to the 305(b) reports submitted by the member states of the Commission. The assessment of lake conditions is based on data collected by the Division of Water in 1981-1983 and updated in 1989 through a lake assessment project funded under the federal Clean Lakes Program. The 99 lakes which were assessed have a total area of 214,861 acres and comprise over 90 percent of the publicly owned lakes in the state. This includes the Kentucky portions of Barkley, Kentucky and Dale Hollow lakes which are border lakes with Tennessee. Total wetland acreage in Kentucky has not been accurately determined. The Division of Water, in collaboration with the Kentucky Department of Fish and Wildlife Resources, has contracted with the U.S. Fish and Wildlife Service to map wetlands in the Commonwealth.

Kentucky's population, according to the 1980 census, is 3,660,257. The state has an approximate area of 40,598 square miles. It is estimated that there are approximately 89,431 miles of streams within the borders of Kentucky. That figure was determined from the Kentucky Natural Resources Information System, which has a computerized geographic database. All of the blue line streams on the 7.5 minute USGS topographic maps were digitized to produce the figure. Main channel and tributary river miles in reservoirs are included. A project is underway to subtract those miles, which will produce a more accurate river and stream mile total. Kentucky has 849 miles of border rivers. The northern boundary of Kentucky is formed by the low water mark of the northern shore of the Ohio River and extends along the river from Catlettsburg, Kentucky in the east to the Ohio's confluence with the Mississippi River near Wickliffe in the west (a length of 664 miles). The

southern boundary is formed by an extension of the Virginia-North Carolina 1780 Walker Line which extends due west to the Tennessee River. Following the acquisition of the Jackson Purchase in 1818, the 36°30' parallel was accepted as the southern boundary from the Tennessee River to the Mississippi River.

Kentucky's eastern boundary begins at the confluence of the Big Sandy River with the Ohio River at Catlettsburg and follows the main stem of the Big Sandy and Tug Fork southeasterly to Pine Mountain, for a combined length of 121 miles; then follows the ridge of the Pine and Cumberland mountains southwest to the Tennessee line. The western boundary follows the middle of the Mississippi River for a length of 64 miles and includes several of the islands in the Mississippi channel. A listing of the above information is provided below.

Atlas

State population (1980 census)	3,660,257
State surface area (square miles)	40,598
Number of major river basins	12
Number of river miles*	89,431
Number of river border miles (subset)	849
Number of lakes/reservoirs	Unknown
Number assessed	99
Acres of lakes/reservoirs	Unknown
Acres assessed	214,861
Wetland acres	Unknown

*includes reservoir main channel and tributary channel miles

The climate of Kentucky is classified as continental temperate humid. Summers are warm and humid with an average temperature of 76°F, while winters are moderately cold with an average temperature of 34°F. Annual precipitation averages about 45 inches, but varies between 40 to 50 inches across the state. Maximum precipitation occurs during winter and spring with minimum precipitation occurring in late summer and fall.

Summary of Classified Uses

Kentucky lists waterbodies according to specific uses in its water quality standards regulations. These uses are: 1) Warmwater Aquatic Habitat, 2) Coldwater Aquatic Habitat, 3) Domestic Water Supply, 4) Primary Contact Recreation, 5) Secondary Contact Recreation and 6) Outstanding Resource Waters. Those waters not specifically listed are classified (by default) for use as warmwater aquatic habitat, primary and secondary contact recreation, and domestic water supply. The domestic water supply use is applicable at points of public and semipublic water supply withdrawal. Lakes have not been listed in the current regulations and are classified for the default uses. Proposed changes to the water quality standards regulations classify major lakes by use, but are not yet formally adopted. The Division of Water adds waterbodies to the classified lists as an ongoing process in its revision of water quality standards. Intensive survey data and data from other studies when applicable are used to determine appropriate uses. Currently, 1,683 stream miles are classified as warmwater aquatic habitat, 384.4 miles as coldwater aquatic habitat, and 206.7 miles as outstanding resource waters. There are approximately 104 points where domestic water supply is withdrawn in streams, and 54 lakes used for domestic water supply purposes.

CHAPTER 1

WATER QUALITY ASSESSMENT OF RIVERS AND STREAMS

WATER QUALITY ASSESSMENT OF RIVERS AND STREAMS

Status

Water quality conditions for rivers and streams in Kentucky are summarized by use support status in Table 1. The table indicates that of the 10,221 miles assessed, approximately 35 percent experienced some degree of use impairment, while 65 percent fully supported uses. Approximately 55 percent of the river miles on the USGS hydrologic unit maps were assessed. This is an increase from stream miles assessed in the 1988 305(b) Report. Corrections on stream lengths were made for this report, so the increase cannot be easily quantified.

Table 1

Designated Use Support by River Basin

Basin	Total Miles	Miles Assessed	Miles Fully Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses
Big Sandy	1133.5	576.2	300.3	47.3	228.6
Little Sandy	356.7	174.3	65.4	31.1	77.8
Tygarts Creek	194.9	193.4	147.9	0.0	45.5
Licking	2,053.1	1037.9	820.1	46.1	171.7
Kentucky	3,416.0	1,698.5	1,143.7	231.5	323.3
Upper Cumberland	2,146.7	992.4	683.9	220.9	87.6
Salt	1,193.4	1,026.2	641.1	87.6	297.5
Green	3,549.4	2,154.5	1,624.0	220.2	310.3
Tradewater	529.2	360.8	151.0	125.7	84.1
Lower Cumberland	648.8	462.1	333.6	107.5	21.0
Tennessee	359.1	128.1	87.1	21.5	19.5
Mississippi	489.4	196.0	142.4	53.6	0.0
Ohio (Minor tribs)	1,756.2	556.7	419.0	74.8	62.9
Ohio (Mainstem)*	663.9	663.9	70.5	344.9	248.5
STATE TOTAL	18,490.3	10,221.0	6,630	1,612.7	1,978.3

*Assessment provided in 1990 ORSANCO 305(b) Report.

Methods of Assessment

Water quality data collected by the Kentucky Division of Water (DOW), Kentucky Division of Waste Management, Ohio River Valley Water Sanitation Commission (ORSANCO), U.S. Army Corps of Engineers, and the U.S. Geological Survey (USGS) were used to determine stream use support status. Other sources of information used in this determination include biological studies at fixed stations,

intensive surveys, and data supplied by the Kentucky Department of Fish and Wildlife Resources. The data were categorized as "monitored" or "evaluated." Monitored data were derived from site specific ambient surveys and were generally no more than five years old. In some instances where watershed conditions remained unchanged, monitored data over five years old were still considered valid and were categorized as monitored. Evaluated data were from other sources or from ambient surveys which were conducted more than five years ago. The criteria for assessing this data to determine use support follow.

Water Quality Data

Chemical data collected by the DOW and the USGS at fixed stations were evaluated according to U.S. EPA guidelines for the preparation of this report. Water quality data collected during the period from October 1987 through September 1989 were compared with state and EPA standards and applied to the status criteria. A list of the parameters and their corresponding criteria are noted in Table 2. All of the criteria in the table, except fecal coliform, were used to assess warmwater aquatic habitat (WAH) use support. If none of the criteria were exceeded in ≤ 10 percent of the measurements and their means were less than the criteria, the segment fully supported its use for WAH. Partial support was indicated if any one criterion was exceeded 11-25 percent of the time and the mean was less than the criterion, or if any criterion was exceeded ≤ 10 percent of the time and its mean was greater than the criterion. The segment was not supporting if any criterion was exceeded >25 percent of the time, or the criterion was exceeded 11-15 percent of the time and the mean was greater than the criterion.

Fecal coliform data were used to indicate degree of support for primary contact recreation use. Primary contact support was evaluated using the methodology described above for the chemical data. In addition, streams with pH's below 6.0 units caused by acid mine drainage were judged to not support this use. Domestic water supply use was not assessed because the use is applicable at points of withdrawal only and could not be quantified in the format required by the guidelines. In areas where both chemical and biological data were available, the biological data were generally the determinate factor for establishing warmwater aquatic habitat use support status.

Fixed Station Biological Data

Biological data for 1985-1989 were collected from 40 fixed monitoring network stations in 12 drainage basins throughout the state. Algae, macroinvertebrates and fish were collected, and community structure metrics, including productivity, biomass, taxa richness, and relative abundance of taxa, were analyzed for each group of organisms. These metrics were used to determine biotic integrity, water quality and designated use support for each reach monitored. Expectations for metric values are dependent upon stream size, ecological region, and habitat quality, and were applied accordingly. Criteria for bioassessment of use support (Table 3) were based on these expectations. Bioassessments integrated data from each group of organisms, habitat data, known physical and chemical parameters, and professional judgement of aquatic biologists.

Algae Algal samples were collected from each biological monitoring station using standardized collection procedures. Plankton chlorophyll a , periphyton chlorophyll a , and periphyton ash-free dry-weight were measured at each site, and diatoms were identified to species and enumerated. Reaches are supporting the WAH use if diatom taxa richness is high, plankton and periphyton chlorophyll a and ash-free dry weight values are near average for the fixed monitoring stations, and the diatom community is

Table 2
Physical and Chemical Parameters and Criteria Used
to Determine Use Support Status at Fixed-Stations

Parameter	Criterion	Source
Dissolved oxygen	<4.0 mg/l	KWQS ¹
Temperature	30°C	KWQS
pH	6 to 9 units	KWQS
Un-ionized ammonia	0.05 mg/l	KWQS
Chloride	250 mg/l	KWQS
Arsenic	50 ug/l	KWQS
Cadmium	Based on hardness ²	EPA ⁴
Chromium	11 ug/l	EPA
Copper	Based on hardness ³	EPA
Lead	Based on hardness ⁵	EPA
Zinc	Based on hardness ⁶	EPA
Fecal coliform	(May 1 thru Oct. 31) 400 colonies/100 ml	KWQS

1) Kentucky Water Quality Standards

2) Criterion = $e^{(.785 \ln x - 3.49)}$

x = hardness in mg/l as CaCO₃

3) Criterion = $e^{(.85 \ln x - 1.465)}$

x = hardness in mg/l as CaCO₃

4) U.S. Environmental Protection Agency

5) Criterion = $e^{(1.27 \ln x - 4.7)}$

x = hardness in mg/l as CaCO₃

6) Criterion = $e^{(.847 \ln x + .76)}$

x = hardness in mg/l as CaCO₃

Table 3
Biological Criteria for Assessment of Warmwater Aquatic Habitat (WAH)
Use Support

	Fully Supporting	Partially Supporting	Not Supporting
Algae	Taxa richness (TR) high, intolerant taxa present, community similarity to reference site >50%, biomass (chlorophyll <u>a</u> , AFDW*, cell density) similar to reference/control or STORET mean.	Reduced number and Relative Abundance (RA) of intolerant taxa, community similarity lower than 50%, increased number or RA of pollution tolerant taxa, increased biomass (if nutrient enriched) of filamentous green algae.	Low TR, loss of intolerant species, pollution tolerant taxa dominant, low community similarity to reference sites, biomass very low (toxicity) or high (organic enrichment).
Macroinvertebrates	Taxa richness, and EPT* index high, community similarity to reference site >50%, intolerant species present.	Taxa richness and/or EPT lower than expected, community similarity <50%, increased RA or numbers of facultative taxa. Reduction in RA of intolerant taxa. Some alterations of functional groups evident.	Taxa richness and EPT low, community similarity low, facultative or pollution tolerant taxa dominant, TNI* of tolerant taxa very high. Most functional groups missing from community.
Fish	Index of Biotic Integrity (IBI) excellent or good, presence of rare, endangered or species of special concern.	IBI fair	IBI poor, very poor, or no fish.

*AFDW - Ashfree Dry Weight, EPT - Ephemeroptera, Plecoptera, Trichoptera, TNI - Total Number of Individuals

dominated by species typical of a stream of that size within that ecoregion. Community similarity between these sites and reference or control sites is >50%. A reach partially supports uses if diatom taxa richness or community similarity to a reference site was low, or if tolerant species abundances are higher than expected. A reach does not support uses if toxic or organic enrichment is indicated by extremely low or high biomass, or if the diatom community is dominated by pollution tolerant species. Expectations for these values are based on average values for sites of similar physical and habitat characteristics, or values derived from the same site at a previous time.

Macroinvertebrates Macroinvertebrates were collected using both artificial substrates and qualitative collections from all available natural substrate habitats. For the macroinvertebrate evaluations, stream reaches are considered to fully support the WAH use if information reflects no alterations in community structure or functional compositions for the available habitats, and if habitat conditions are relatively undisturbed. A reach is considered partially supporting uses when information reveals that community structure is slightly altered, that functional feeding components are noticeably influenced, or if available habitats reflect some alterations and/or reductions. Reaches are considered not supporting uses if information reflects sustained alterations or deletions in community structure, taxa richness and functional feeding types, or if available habitats are severely reduced or eliminated.

Fish Fish were collected for community structure evaluation at selected biological monitoring sites. The condition of the fish community was determined by analysis of relative abundance, species richness and species composition, and the use of an Index of Biotic Integrity (IBI). The IBI was used to assess biotic integrity directly by evaluation of twelve attributes, or metrics, of fish communities in streams. These community metrics include measurement of species richness and composition, trophic structure, and fish abundance and condition. The IBI was used to assign one of the following categories to a fish community: excellent, good, fair, poor, very poor, or no fish. Reaches fully supporting uses have an IBI of excellent or good, reaches partially supporting uses have an IBI of fair, and reaches not supporting uses have an IBI of poor, very poor, or no fish.

Intensive Survey Data

In the 1988-1989 biennium, nine intensive surveys were conducted to determine if target streams were supporting their designated uses. Data were also evaluated for 36 additional surveys conducted between 1982 and 1987. Streams intensively surveyed more than five years ago are considered as "evaluated waters", whereas streams surveyed more recently are "monitored waters".

The streams were assessed by evaluating the biological communities (refer to Table 3), physicochemical, toxicity, and habitat data, as well as known watershed activities in concert with direct observation and professional judgement. Stream mileages were grouped as supporting, partially supporting, or nonsupporting designated uses. Streams are considered to support designated uses if no impacts, or only minor impacts to the biotic integrity, physical habitat, and water quality are observed. Streams are determined to be partially supporting when the data indicate either stressed biotic communities, minor violations of water quality criteria, or some physical impairment to aquatic habitats. Nonsupporting streams are those showing severe stress, such as sustained species deletions, trophic imbalances in the biotic communities, chronic violations of water quality criteria, and severely impaired aquatic habitats.

Kentucky Department of Fish and Wildlife Resources Data

The Division of Water extended its analysis of stream use support by developing questionnaires on unmonitored streams and sending them to Conservation Officers of the Kentucky Department of Fish and Wildlife Resources (KDFWR). The questionnaire results were utilized in the evaluated category of assessed waters. Sixty-six of 120 questionnaires were returned, a response of slightly over 50 percent.

Each questionnaire was divided into two sections. A habitat evaluation section included questions on major land uses in the stream basin, flow, bottom type, sedimentation, and water quality. If water quality was stated to be less than good, the respondent was asked to indicate why a fair or poor evaluation was given.

Fisheries support was evaluated through questions regarding stream fishery characterization, reproduction (as indicated by presence or absence of both young-of-year (y-o-y) and adult sport fishes), fishery success, and trend of the fishery over the last 10 years. If the fishery was felt to be poor, the respondent was asked to indicate why.

In this evaluation of use support, only those questionnaire responses indicating definite support or nonsupport were used. Partial support was not assessed. A stream was considered to fully support WAH use if:

- (1) the stream supported a good fishery,
- (2) both y-o-y and adult sport fishes were present, or if only y-o-y were present, the stream was a tributary to a stream supporting the WAH use, and
- (3) water quality was judged good.

A stream did not support the WAH use if:

- (1) the stream supported a poor fishery,
- (2) few or no fish were present in the stream, and
- (3) water quality was judged poor and/or repeated fish kills were known to occur.

The questionnaires proved useful in evaluating the support or nonsupport of use in streams. The concept of utilizing sport fishery information was adopted from the Illinois 1986 305(b) report. While the questionnaire was somewhat rudimentary, it was useful and helped to increase the number of assessed streams in the state.

Another source of data for the evaluated category was a list of streams recommended by the KDFWR as candidates for State Outstanding Resource Waters. They were recommended because of their outstanding value as sport fishing streams. These streams were assessed as fully supporting warmwater aquatic habitat use if there was no data which conflicted with the assessment.

Other Data Sources

The classification of streams as coldwater aquatic habitats (CAH) in Kentucky's water quality standards regulations are established from data provided by the KDFWR. Their field surveys indicate which streams can support a sustainable year around trout fishery. These streams were considered to fully support their CAH use and were considered as monitored waters in the assessment.

Recent field work, conducted for the U.S. Fish and Wildlife Service, identified streams in Kentucky which harbored the blackside dace, a federally endangered species of fish. This work was considered as monitored data. These streams are automatically classified as State Outstanding Resource Waters and were judged to fully support the WAH use.

Streams surveyed by the Kentucky State Nature Preserves Commission for a special project to obtain background aquatic biota and water quality data in the oil shale region of the state were utilized as "monitored" information in this report. The information was published in a 1984 report entitled Aquatic Biota and Water Quality and Quantity Survey of the Kentucky Oil Shale Region.

An announcement was placed in the Newsletter of the Kentucky Academy of Science (KAS) which requested that current academic or other published reports on biological data from streams in the state be sent to the DOW for use assessment purposes. Two reports were received and both were utilized in the assessment. This approach will be tried again for the next 305(b) Report because KAS members could become a new source of biological data for many streams in the State.

Use Support Summary

Table 4 shows the results of the evaluated and monitored assessments on a statewide basis. The threatened category refers to stream miles which were judged to be in danger of use impairment from anticipated land use changes or development of trends indicating possible impairment.

Table 1 has more total assessed miles and more miles in the partial support category because it included conclusions from ORSANCO's assessment of the mainstem of the Ohio River and Missouri's assessment of the Mississippi River. Both tables follow EPA guidelines which define fully supporting as meaning that all uses which were assessed had to be fully supporting before a segment could be listed under that title. If a segment supported one use, but did not support another, it was listed as not supporting. For instance, if a segment supported a warmwater aquatic habitat use, but not a primary contact recreation use, it was listed as not supporting. A segment would be listed as partially supporting if any assessed use fell into that category even if another use was fully supported. Many streams were assessed for only one use because data were not available to assess other uses.

Causes of Use Nonsupport

Table 5 indicates the relative causes of use nonsupport. Stream segment lengths which either did not support or partially support uses were combined to indicate the miles that were affected. Fecal coliform bacteria (pathogen indicators) were the greatest cause of use impairment and affected primary contact use in 1,423 miles of streams and rivers. Organic enrichment/dissolved oxygen was the second greatest cause of use impairment. It impaired warmwater aquatic habitat use in 500 miles of streams and rivers and moderately impacted an additional 23 miles. Organic enrichment lowers dissolved oxygen in streams which causes stress on aquatic life. Siltation was the third greatest cause of use impairment. It impaired warmwater aquatic habitat use in 406 miles of streams. Siltation affects the use by covering available habitat, preventing aquatic organisms from inhabiting streams that could normally support them.

Table 4
Summary of Assessed* Use Support

Degree of Use Support	Assessment Basis Evaluated	Monitored	Total Assessed
Miles Fully Supporting	4,375.2	2,054.4	6,429.6
Miles Fully Supporting but Threatened	6.7	123.2	129.9
Miles Partially Supporting	361.0	906.8	1,267.8
Miles Not Supporting	480.4	1,249.4	1,729.8
TOTAL	5,223.3	4,333.8	9,557.1

*Excludes mainstems of Ohio and Mississippi rivers; refer to ORSANCO and Missouri 305(b) Reports for assessments.

Sources of Use Nonsupport

Sources of use nonsupport were assessed under point and nonpoint categories and are listed in Table 6. Nonpoint sources as a whole affected about twice as many miles of streams as point sources. Municipal point sources and agriculture nonpoint sources were the leading sources of use nonsupport, each affecting over 1,000 miles of streams. Primary contact recreation was the major use impaired by municipal sources and was caused by fecal coliform pollution. Agriculture affected warmwater aquatic habitat use because of siltation and primary contact recreation use because of fecal coliform contamination.

Table 5
Causes of Use Nonsupport in Rivers and Streams

Cause Category	Miles Affected	
	Major Impact	Moderate/Minor Impact
Pathogen indicators	1423.5	0
Organic enrichment/D.O.	500.4	23.4
Siltation	406.1	18.3
pH	261.2	13.3
Metals	249.4	146.4
Nutrients	222.0	32.1
Salinity/TDS/Chlorides	164.0	20.1
Priority organics	124.8	0
Unknown toxicity	109.5	13.0
Other habitat alterations	98.2	54.8
Oil and grease	37.3	0
Suspended solids	35.0	0

Table 6
Sources of Use Nonsupport in Rivers and Streams

Source Category	Miles Affected	
	Major Impact	Moderate/Minor Impact
Point Sources		
Municipal	1151.3	25.4
Industrial	182.5	29.7
Combined sewer overflows	<u>0</u>	<u>0</u>
TOTAL	1333.8	55.1
Nonpoint Sources		
Agriculture	1046.2	184.7
Resource Extraction	833.4	34.3
Urban runoff/Storm sewers	218.7	41.6
Hydro-Habitat modification	153.0	0
Land disposal/Septic tanks	74.9	49.5
Construction	<u>2.5</u>	<u>0</u>
TOTAL	2328.7	310.1
Unknown	204.3	0